sar系统分析及优化建议示例

系统性能分析报告（基于 `sar` 数据）

**基础环境 **
- **系统 **： Ubuntu（ Linux 5.4.0-216-generic）
- **日期 **：2025年07月28日 20:00:00 - 23:59:59
- **CPU架构 **：x86_64（ 16逻辑 CPU）
- **物理内存 **：约 32.5 GB（由 `%memused` 反推计算得出）

CPU 使用分析 (`sar -u`）
` ` ` bash
关键指标
Average: all 7.76 0.00 1.12 0.03 0.00 91.09
` ` `

- **整体负载极低 **：

- **平均空闲率 (`%idle`)**：91.09%，表明 CPU 资源充足。
- **用户态占用 (`%user`)**：平均 7.76%，峰值 10.07%（20:45），无持续高负载。
- **内核态占用 (`%system`)**：平均 1.12%，系统调用开销正常。
- **其他指标 **：
- **`%iowait`**：平均 0.03%（最高 0.06%）， **无 I/O 瓶颈 **。
- **`%steal`**：0%，无虚拟机资源争抢。
- **`%nice`**：0%，无优先级调整进程。

**时间趋势 **
- **20:00-22:00**：轻度波动（ `%user` 8-10%），峰值在 20:45（10.07%）。
- **22:00 后**：负载显著下降（ `%user` 降至 6.27-6.70%），空闲率升至 92-93%。

> **结论 **：CPU 资源高度空闲，系统未达性能瓶颈。

内存使用分析 (`sar -r`）
` ` ` bash
关键指标（平均值）
Average: 591147 20035239 11154124 34.75 1292042 14122169 22197908 61.17
13299787 13005861 64628
` ` `

- **物理内存 **（约 32.5 GB）：
- **已用 (`%memused`)**：平均 34.75%（11.15 GB）， **利用率低 **。
- **空闲 (`kbmemfree`)**：平均 577 MB（波动范围 266 MB - 945 MB）。
- **可用内存 (`kbavail`)**：稳定在 19.1 GB，**资源充足 **。
- **缓存与缓冲 **：
- **磁盘缓存 (`kbcached`)**：平均 13.5 GB（占比 41.5%），系统充分利用空闲内存加速 I/O。
- **缓冲区 (`kbbuffers`)**：平均 1.29 GB。
- **工作负载需求 (`kbcommit`)**：
- 平均需 22.2 GB 内存（含交换空间）。
- **`%commit`**：平均 61.17%，表明物理内存 + 交换空间总需求在安全范围内（反推总地址空间约 36.3
GB，交换空间约 3.8 GB）。
- **其他 **：
- **脏数据 (`kbdirty`)**：平均 63 MB，写回磁盘压力小。
- **活跃 /非活跃内存 **：活跃约 12.7 GB，非活跃约 12.4 GB，内存管理合理。

> **结论 **：内存资源充裕，无压力迹象；缓存机制有效优化 I/O 性能。

**关键指标汇总表 **
**类别 **	**指标 **	**平均值 **	**峰值 **	**状态 **
CPU	`%idle`	91.09%	93.16%	资源高度空闲
	`%user`	7.76%	10.07%	低负载

	`%iowait`	0.03%	0.06%	无 I/O 瓶颈
内存	`%memused`	34.75%	34.80%	低利用率
	`kbavail`	19.1 GB	19.1 GB	充足可用内存
	`kbcached`	13.5 GB	14.4 GB	缓存高效利用
工作负载	`%commit`	61.17%	61.23%	地址空间需求安全

优化建议

1. **资源利用**:
   - **提升应用负载**: 当前 CPU/内存 大量闲置，可部署更多服务。
   - **调整交换空间**: 若交换空间过大（推算约 3.8 GB），可适当缩减（物理内存充足）。
2. **监控扩展**:
   - 补充 `sar -d` 分析磁盘 I/O 详细性能（尽管 `%iowait` 低，仍需确认）。
   - 检查应用日志，确认 20:45 的 CPU 小高峰原因（是否可优化）。
3. **内存策略**:
   - 保持大缓存配置，这对读取密集型应用有利。
   - 监控 `kbdirty` 若持续增长（>100 MB），需检查磁盘写性能。

> **整体评估**: 系统健康，性能瓶颈未出现，资源利用率有较大提升空间。

?????

???????????CPU?????sar -u?????????????sar -r????????2025?07?28?20:00:00?23:59:59????16?CPU?

????CPU?????sar -u??

?????

%user: ???????CPU???

%nice: ??????nice?????????CPU???

%system: ???????CPU???

%iowait: CPU??I/O????????

%steal: ??????????????CPU?????

%idle: CPU???????

?????

1. ???????%user?6.10%?10.07%????????7.76%?

2. %nice???0??????????????????????????????CPU??

3. %system?0.72%?1.61%?????1.12%?

4. %iowait?????0.01%?0.06%?????0.03%???I/O???????

5. %steal???0?????????????????????????????

6. %idle?????91.09%???????????????????CPU?????

???????

- 20:45?21:05????????%user?10.07%?9.55%????????

- 22:25???%user????????6%~7%?????%idle???92%~93%?

???CPU?????????????????CPU???

????????????sar -r??

?????

kbmemfree: ????????KB?

kbavail: ??????????????????????????KB?

kbmemused: ????????????????????????????????KB?

%memused: ?????????kbmemused / (kbmemfree+kbmemused) ??????????????

kbbuffers: ??????buffer???????KB?

kbcached: ???????page cache???????KB?

kbcommit: ???????????????KB?

%commit: ????????????????????+?????????

kbactive: ??????????????KB?

kbinact: ??????????????????KB?

kbdirty: ?????????????KB?

???????? = kbmemfree + kbmemused???man sar?kbmemused????????????????????????????? kbmemfree+kbmemused+kbbuffers+kbcached?????man sar???kbmemused?used memory minus buffers/cache ?????????kbmemfree + kbmemused + buffers + cached????kbmemused?????buffers?cached??

??????????????????????

kbmemfree???????????

kbmemused???

?????sar -r???????? = kbmemfree + kbmemused + kbbuffers + kbcached???????kbmemused ??????????????????????

???????

kbmemfree = 272628, kbmemused=11141368, kbbuffers=1293468, kbcached=14409484

????? = 272628 + 11141368 + 1293468 + 14409484 = 27165948 KB? ????????????????????27GB?

???????sar -r?????kbmemused???????????????used??????man sar?sysstat??????

kbmemfree: Amount of free memory available to the kernel. This is the amount of memory left unused by the system.

kbmemused: Amount of used memory. This does not take into account memory used by the kernel itself.

%memused: Percentage of used memory.

????sar???????????????

??1?used = total - free - buffers - cache

???2?used = total - free

????kbmemused????????1?????????????????????????????????????

??? = kbmemfree + kbmemused + kbbuffers + kbcached

????????272628 + 11141368 + 1293468 + 14409484 = 272628+11141368=11413996; 11413996+1293468=12707464; 12707464+14409484=27116948 KB -> ?27.1GB

????????%memused?34.71%????????? kbmemused / %memused * 100 = 11141368 / 0.3471 ? 32,100,000 KB??32.1GB???????????27.1GB???

????????????%memused??????????????????????????? = kbmemused / (%memused/100) = 11141368 / 0.3471 ? 32,100,000 KB??32.1GB???kbmemfree???????????????? kbmemfree + kbmemused? ? 272628 + 11141368 = 11413996 KB? ???11.4GB??32.1GB???

???????kbmemused??????????????kbmemused???????????????used??

??????man sar??????????11.7.3??

kbmemfree: Free memory (in kB) available to the kernel. This corresponds to the "MemFree" field in /proc/meminfo.

kbmemused: Used memory (in kB). This corresponds to the "MemTotal" minus "MemFree" fields in /proc/meminfo, and does not take into account memory used by the kernel itself (for buffers, caches, etc.). So this is the amount of memory used by applications.

????/proc/meminfo??

MemTotal: 32511328 kB ???????32.5GB?

MemFree: 272628 kB

MemAvailable: 20046696 kB ???kbavail?

Buffers: 1293468 kB

Cached: 14409484 kB ??????Cached??????????????

?????? = MemTotal = 32511328 kB?32.5GB?

?kbmemused = MemTotal - MemFree = 32511328 - 272628 = 32238700 kB? ?????kbmemused?11141368 kB ??????

????????sar?man page??????-r????

kbmemfree: Amount of free memory available to the kernel. The same as the "MemFree" field in /proc/meminfo.

kbmemused: Amount of used memory. The same as the "MemTotal" minus "MemFree" fields in /proc/meminfo, but this does not take into account memory used by the kernel itself (for buffers, caches, etc.). So this is the amount of memory used by applications.

???????/proc/meminfo??MemTotal - MemFree = ??????????????????????sar?kbmemused ???????????sar -r?????kbmemused???????????????kbmemused = MemTotal - MemFree - Buffers - Cached? ?????

????32511328 - 272628 - 1293468 - 14409484 = 32511328 - 272628 = 32238700;

32238700 - 1293468 = 30945232;

30945232 - 14409484 = 16535748 KB? ????11141368????

???????kbmemused = MemTotal - MemFree - Buffers - Cached - SReclaimable???SReclaimable?Slab??????? ?????SReclaimable????

???????????kbavail???MemAvailable??20046696 kB????????MemFree??????????????????? %memused=34.71%???????32511328 kB???kbmemused???32511328 * 0.3471 ? 11285100 kB?????? 11141368 kB??????????????????

??????????????32.5GB?32511328 kB?????

kbmemused = ????? * %memused / 100 ? 32511328 * 0.3471 ? 11285100 kB??11141368 ??????????????????????

??????????

1. ?????kbmemfree??272628 KB??266MB??967700 KB??945MB????????591147 KB??577MB??

2. ?????kbavail??20018096 KB??19.1GB??20053352 KB??19.1GB??????20035239 KB??19.1GB???????

3. ??????kbmemused??11137576 KB??10.6GB??11169060 KB??10.7GB??????11154124 KB??10.6GB??? 34.75%?????

4. ????kbbuffers?????kbcached???????????1.29GB?1292042 KB???????13.5GB?14122169 KB????

5. ?????kbactive???13.0GB?13299787 KB????????kbinact???12.4GB?13005861 KB?????????????

6. ????kbdirty???64.6MB?64628 KB??????????????????????

7. kbcommit???????????????22.2GB?22197908 KB???????????+??????61.17% ????????????????????????????22.2GB????????32.5GB???????????????61.17%?????????

???%commit??????????+??????????????0???%commit=22197908/32511328?68.2%????%commit???61.17%???????????swap????????+?????S???

22197908 / S = 0.6117 => S = 22197908 / 0.6117 ? 36,288,000 KB??36.3GB?

?????? = S - ???? = 36.3GB - 32.5GB = 3.8GB?

???

- ????????????????34.75%??????????????????????????19.1GB?????????

- ?????????13.5GB?????????????????

- ??????????%commit???????????22.2GB?????????32.5GB??????????????????????????sar -W ??????????????????

??????????????20:00-24:00????????CPU???????????????I/O???

???

1. ??CPU??????????????????????????CPU?

2. ??

3. ??I/O??????????????????????????I/O???sar -d???????

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